

2B: Toxic Contaminants

Questions & Answers

Q: Regarding your data for Foulweather Bluff: Could the naval base in Hood Canal have anything to do with it? There is an extremely large current from Hood Canal that affects Foulweather bluff, and I thought that current might carry some mercury from the naval base to that location.

A: It's quite a ways away. Intuitively, I wouldn't expect that. But we have English sole samples that are from around the area of the Hood Canal Bridge. We don't see elevated levels of mercury in that species, although it is a different kettle of fish, sort of. But I do think that's quite a distance.

Q: Sandra, I'm assuming that this is true since you didn't mention it but, that there isn't any separate coded wire data for the delayed hatchery fish program.

O'Neill: There are coded wire tag data. These data show that when you sample in the winter when the fish should not be resident in Puget Sound, you get higher recoveries for south sound net pen fishes than you do for stocks from northern Puget Sound. This suggests that, in fact, the net pens are doing what they were intended to do. The use of net pens does appear to result in fish being more resident.

Q: Since your samples were composites of multiple fish, you weren't able to tease that out, I take it, in your data?

O'Neill: Not all the fish that we collect have coded wire tags on them. Our South Sound samples usually come from a mixed stock: some are wild and some are from hatcheries. We separated the fish in our composites so that hatchery fish were together in one sample and wild fish together in another. However, our composite hatchery samples may include some hatchery fish that were from net pens and some that weren't. For example, we might have had five fish in a composite and only one of them had a coded wire tag saying that it was from a net pen in southern Puget Sound.

Q: Jim, it's probably the same data but, one thing that struck me in looking at your rock-fish data was there may be differences in the population dynamics at these different locations. That is the age-structure, sex ratios, and so on. Do you have enough data from any of these areas to be able to look at that issue?

West: I'll give you your five dollars later. Yes, actually, one of the fingerprints we're using to get at that is the growth rate data. And we do have good growth rate data for these locations, as well as many more, and we find varied location-specific growth rates, and some that are quite strikingly different. Our age-frequency data are not really usable because we don't apply our sampling in a manner that allows us to do that. We are essentially biased in the way we are collecting our samples for age frequency. But we are planning to use growth rate as sort of a fingerprint of a local regional stock. And actually there is a lot of interest in using that in order to try to demonstrate that these fish don't move around very much.

Q: Sandra, I was wondering about the discrepancy in PCB content in marine caught fish vs. fish caught in the river—whether it might possibly be explained by the osmoregulatory processes that the salmon go through. When they are heading back into fresh water, they tend to change the chemistry in their bodies. I was wondering whether that had any effect on that discrepancy or if that was considered, or what your views were on that?

O'Neill: Well, you've got me. Most of the contaminants that are in their tissue probably accumulated over a fairly long period of time. All I can tell you is I know the lipid content tends to be lower in river

fish. I don't know if the percent solids and things like that are that different. They don't look it, but I haven't run the tests statistically. But someone like Frieda Taub might be able to answer that. She's sitting over there. What do you think, Frieda?

Taub: I'm going to ask you another question, but it's related. When the salmon are caught on the high seas, before they approach the land, do they have high PCBs or low PCBs? Are they picking up the material either from the water or from food – presumably a lot of them are not feeding once they enter fresh water. Now there's been, I think, substantial studies showing that fish can pick up substantial amounts of PCB just across their gill surfaces, and there are some models that EPA has that could explore this. We could set the food input to zero and have PCBs in the water and it will tell us how much would come in through the gills, but I never believe mathematical models. I'd rather know what the fish are doing.

O'Neill: So you're suggesting that the PCBs are being accumulated quite rapidly, just as they enter Puget Sound?

Taub: Well somebody must have PCB values for salmon before they've been impacted by the rivers.

O'Neill: Well, the only other salmon PCB data that I've seen is some from Alaska for various fish species, and I think National Marine Fisheries Service did the analysis. They had PCBs in their tissues at similar concentrations as seen in Puget Sound. I didn't have lipid content data for these measurements and they were analyzed as congeners, but just eyeballing them, they looked about the same. I would think that the PCBs are probably accumulating through the food chain in general. We did a little pilot study of herring in Puget Sound in 1995 where we sampled herring at Fidalgo Bay. We measured concentrations in whole herring and found that they have PCBs in their tissues that are up as high as 200 ppb. Those fish are not going out to the north Pacific. So there are PCBs in the food chain. The fact that they have such oily tissues and the PCBs are so lipophilic, my gut intuition would tell me that it is probably accumulated through the food chain over a period of time, rather than in the short time that they are swimming.

Taub: As far as the fresh water-salt water, I guess most of the studies that I'm aware of have really focused on the salt glands in the gills, and I do not know whether that would impact how they would handle PCBs.

O'Neill: A lot of the in-river fisheries, or river-mouth fisheries, are not in pure fresh water, and so they are more estuarine rather than in river. One of the big differences between our marine and in river comparison is that they're not balanced. The marine side of the sampling was only in central and southern Puget Sound whereas the in river part included some north Sound, so it's not really a balanced design.

Q: I would add to that last discussion, that we had the same question on the Columbia River, where we collected data from fish in the river and they had high concentration of PCBs and dioxins. No one had any ocean fish data, however, and still we had to go back to the Alaska data that Sandra just mentioned, which is not really a very good study for this purpose. I believe that NOAA out of Newport labs is attempting to get some ocean-caught data this year but, that kind of depends on whether or not there is any fishing seasons this year. I had one more question for Eric, if I might. Eric, you had a lot of data on metals concentrations and dissolved and total. I'm wondering about what you said at the end of your talk that concentrations were below the water quality standards. Did you take a look at the ratios of total to dissolved that you came across in your studies and compare those to the ratios that we have established in the state water quality standards to see what that variation might have been?

Creclius: No, I didn't make a comparison with the ratios you're referring to. Sorry.

Q: The reason I ask, of course, is that we base our standards on EPA recommended criteria and we just changed those in November based on new recommendations from the EPA. I have no idea how they compare to your data but it would be interesting to take a look at that.

Creceilius: The EPA water quality criteria are based on, I believe, total recoverable metal.

Q: Well, they now have total to dissolved ratios that they have established for national recommendations, and we adopted those into our standards.

Creceilius: OK, in most cases the ratio of dissolved to total in these was typically what you might expect in what's been seen in other coastal areas in the world. Predominantly, for example, cadmium is usually 95% dissolved and lead is usually only 10 or 20% dissolved. So I don't think there were any surprises there.

Q: Jim, it's apparent that you don't want to catch that very smart, very old, 65-year-old fish in Sinclair Inlet. What does this mean in terms of human health. One milligram per kilogram is close to FDA's level of concern for mercury. Do people tend to catch the very young, dumb fish, or are those old, smart fish the ones that are actually caught and being consumed by humans, and therefore, where the risk may lie.

West: Well, there's a lot in that question. First of all, implicit is why aren't there older fish around and I don't know. Wayne Palsson might be able to shed some light on that. It may be the result of 100 years of fishing. And people tend to catch, or fishing gear tends to select the oldest, or the largest fish. Actually, Sinclair Inlet is not even a very good habitat for rockfish. The samples that we got were gotten fortuitously, but you're right in that the individual concentrations do exceed FDA limits, which are not strictly human health based limits. They have economic multipliers in them. More human health based criteria, or action limits are levels around 0.5 parts per million, which lots of our samples exceed. In fact, Sinclair Inlet was closed to bottom fishing because of some of these results. So, the Department of Health is aware of the data. We throw them at them as fast as we can. It's not very clear to us what are considered protective levels. We're not risk assessors or anything like that.

Q: I'm going to jump back into the fray on the PCBs in the coho and chinook again. At least on global scale, there is some evidence that has come out in the last five years or so that PCBs and pesticides have a global fractioning or partitioning with higher concentrations in open-ocean water being found at the higher latitudes compared to lower latitude. Is there any evidence that maybe chinooks, which have the higher PCBs, go further north in their migrations than do the coho? Is that a possible explanation?

O'Neill: I'm not sure about this, but I think that chinook, in general, migrate further out into the north Pacific than do coho as a species as a whole. I'm pretty sure that's right. But I don't know anything about contaminant levels in the north Pacific – north temperate vs. south temperate. Certainly some of the highest PCB sites on the West Coast for sediment contamination occur right in Puget Sound. The Duwamish Waterway is very contaminated. Hylebos Waterway and City Waterway or Thea Foss Waterway in Commencement Bay are very contaminated. If you went further north in Alaska, I don't know if there are some PCB hot spots, but I don't think you'd find really localized contaminants like you would here. PCB's can be transported by air to all kinds of remote areas, including high arctic lakes, so it's possible, but I would put money on trophic status in aged fish.

Q: Did you measure the methyl mercury as well?

A: No, we measured total mercury. It's too expensive to measure methyl mercury, but the best

information we have suggests that methyl mercury is about 95 or 96 percent of the total mercury. So, you can tweak those numbers down a notch if you're worried about 5 percent.

Q: Have you done any sediment samples for the last two species, because I think if you spent 10% of your budget on the sediment samples, you may have a clearer picture of the whole area you are studying, and probably, to help you to explain your data.

West: There's actually quite an extensive sediment monitoring effort that's already in place, and we use their data as best we can. For rockfish, where they live sort of precludes sedimentation. They live in rocky habitats or hard bottom, usually. So it's difficult. People tend not to break their equipment on the rocks. So we don't have very good sediment information or source information for rockfish, and we might not ever. But for salmon, I don't know that we would expect to be able to tie them to sediments because they move around so much and they are migratory. Your question pertains mostly, I think, to English sole, which Sandie will be talking about tomorrow where there's a really good, tight relationship between sediment levels and, I think, liver lesions and contaminants. She'll be talking about that.

O'Neill: I'm going to put a plug in for Ed's work, though. With the type of sampling that Ed is doing now, we will be able to make estimates of what proportion of central Puget Sound vs. northern Puget Sound is contaminated. And I have no doubt that we'll see, based on the sediment chemistry, that central and southern Puget Sound will overall be more contaminated than northern Puget Sound.

Q: I was just curious to know if you are using any of this information at all on the work that's being done on Puget Sound Navy Base and their Superfund site, because a lot of it could be complied in our efforts to try to negotiate the clean up there at Puget Sound Navy Base. It's probably going back to this morning, when they were saying that you guys with PSAMP could connect better. This is perfect for that, and all the information that you've collected in Sinclair Inlet. The minute rockfish were closed to the taking in Sinclair Inlet, we were on the Navy about that, and how it was showing up because it's very well known that they did a lot with mercury at the Navy base. It was left in open pits, and left for the tide to wash right out into the bay. So it all correlates, and you should definitely take a part in that process.

O'Neill: John, we've actually met with several Navy people from time to time, and given them a briefing, not just on the rockfish, but also on the English sole, and several of them have requested data sets from us. So they are aware of the data. Whether they tell you that they are aware of the data, I don't know. But they are definitely aware of the data. And the English sole data from there are quite interesting as well. We see elevated lead levels at Sinclair Inlet; we've let them know about that as well.

Q: As a biologist working on it, we get volumes of stuff from the Navy on this stuff, and if you could just maybe highlight some of this information for us and funnel that to us, it would really help.

A: One of the things that we are trying to make them aware of is that we can't see information that is sort of an unidentified flat fish, no age information, no species. The whole point behind what we're trying to do is show how these factors are important, and that if they're going to be taking their own samples and making comparisons, they need to account for those factors. So we haven't really met with them directly about that stuff. We're hoping it will happen through these kinds of forums.

Q: Well, they meet, but they are not real open. They invite you and they make it public, but, they would just as soon we not show up in a lot of cases, so, if we do show up, it's nice to have the information in hand when we're there.